RISK MANAGEMENT INDEX

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ABSTRACT

Because of the complex nature, risk and uncertainty are more widespread in construction industry than many other industries. The risk management is an indispensable discipline for any organisation to achieve its objectives. Aiming to ensure that all project objectives are met, risk management is considered as a critical success factor for construction projects. The core components of risk management are now known and utilised by many organizations. Meanwhile, as declared by Project Management Institute (PMI), the ability to measure the effectiveness in managing risk is one of the most vital areas that risk management needs to be developed in. Created to evaluate the capability of a project or an organization in a particular area, a maturity model aids in determining strengths and weaknesses, and to target advance strategies accordingly. Several maturity models have been developed for the area of risk management and furthermore, an attempt to adapt a generic risk management maturity model to the construction industry was specified from the literature. Outstanding risk management maturity models were investigated, six of them were identified as being competent and further examined in terms of their usability and effectiveness. Based on the comparisons and evaluation made among the models, several advantageous and disadvantageous points were inferred. All in all, when examined, it was seen that most of these models outline the topics to be observed in a maturity assessment and provide guidance in terms of content. It was believed that a practical approach was needed and the diagnostic characteristics of these models should be improved.

ABSTRAK

Oleh kerana sifat kompleks , risiko dan ketidaktentuan yang lebih meluas dalam industri pembinaan daripada banyak industri-industri lain . Bertujuan untuk memastikan bahawa semua objektif projek dipenuhi, pengurusan risiko dianggap sebagai faktor kejayaan kritikal bagi projek-projek pembinaan. Teras-teras pengurusan risiko kini dikenali dan digunakan oleh banyak organisasi . Sebaliknya , seperti yang diisytiharkan oleh Institut Pengurusan Projek (PMI), kemampuan untuk mengukur keberkesanan dalam menguruskan risiko adalah salah satu kawasan yang paling penting bahawa pengurusan risiko perlu dibangunkan masuk Direka untuk menilai keupayaan projek atau organisasi di kawasan tertentu, yang alat bantuan model kematangan dalam menentukan kekuatan dan kelemahan , dan untuk sasaran strategi penambahbaikan sewajarnya. Beberapa model-model matang telah dibangunkan untuk bidang pengurusan risiko dan tambahan pula, usaha untuk menyesuaikan diri pengurusan risiko model kematangan generik dengan industri pembinaan telah dinyatakan dari penulisan. model-model matang pengurusan risiko yang cemerlang telah diperiksa , enam daripada mereka telah dikenal pasti sebagai cekap dan dikaji lebih lanjut dari segi kebolehgunaan dan keberkesanannya. Menurut perbandingan dibuat antara model , beberapa mata berfaedah dan merugikan telah disimpulkan . Semua sekali, apabila diteliti , ia dilihat bahawa kebanyakan model ini menggariskan topik yang akan disiasat dalam penilaian kematangan dan memberi bimbingan dari segi kandungan . Ianya dipercayai bahawa pendekatan yang praktikal yang diperlukan dan ciri-ciri diagnostik model ini harus ditingkatkan.

TABLE OF CONTENTS

CHAPTER 5 CONCLUSION AND RECOMMENDATION

LIST OF TABLES

LIST OF FIFURES

LIST OF ABBREVIATIONS

CMM	Capability Maturity Model
PMI	Project Management Institute
RM	Risk Management
RMM	Risk Maturity Model
RMMM	Risk Management Maturity Model

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Construction project development is always shrouded by risks. Usually developers will try to control or absorb the risks but sometimes it has to be transferred to other parties, including end users and they are the ones to bear the costs. According to Flanagan and Norman (1993) begin the process of project (feasibility study) to the completion of the project took a long time. The construction industry is subject to more risk and uncertainty than many other industries. It involves many complex skills and involves more complex activities. According to Mills: "The construction industry is one of the most dynamic, risky, and challenging businesses" (2001, p.245).

According to Flanagan and Norman (1993) stated that, despite the existence of risks inherent in the development of this sector, it is surprising techniques that are used to identify, analyse and respond to risk just started to be used in the last decade. Many would agree that the risk significantly influence business decisions and have a significant impact on investment returns. Basically, the risk is attributed from uncertainty or due to the lack of information. Through effective information management, one is able to determine relevant information, up to date and accurate. Only this information alone can ensure that an organization can be collated and managed to achieve their business objectives effectively (Hollingworth, 1986) further intuition, skills and judgments are continually influencing one's decision-making.

Therefore, it is important for the effective control of project management, all significant risks and uncertainties are identified, classified, analysed, treated and monitored in a systematic response by the project management team to achieve the project objectives. The risk management index was designed to assess risk management performance. It provides a qualitative measure of management based on predefined

targets or benchmarks that risk management efforts should aim to achieve. The index estimates the performance of risk management in terms of risk identification, risk reduction, disaster management, governance and financial protection.

Due to its complex nature, risk and uncertainty are more widespread in construction industry than many other industries. Aiming to ensure that all project objectives are met, risk management is considered as a critical success factor for construction projects. The core elements of risk management are now known and used by many organizations. On the other hand, as declared by Project Management Institute (PMI), the ability to measure the effectiveness in managing risk is one of the most important areas that risk management needs to be developed in. Designed to assess the capability of a project or an organization in a particular area, a maturity model aids in determining strengths and weaknesses, and to target improvement strategies accordingly. Several maturity models will be developed for the area of risk management.

Being one of the nine knowledge areas of project management, risk management is now an accepted discipline within organization and individual projects, with its own language, techniques, procedures and tools (Project Management Institute, 2002). Risk management aims to ensure that all activities are fulfilled in order to achieve the project objectives (Flanagan and Norman, 1993). The value of risk management is increasingly being recognized by companies as they are searching for improvement steps to become more competitive in industry. As claimed by Project Management Institute (2002), although the core elements of project risk management are known and used by many organizations, risk management needs to be developed in a number of areas to build on the foundation that currently exists. Project Management Institute (2002) declares the ability to measure the effectiveness in managing risk as one of the most vital of these. According to Hilson (1997), an organization's current approach to risk, as well as a definition of the intended destination should be identified to define its goals, specify the process and manage the progress. Therefore, as Hilton (1997) continues, an accepted framework is needed to assess the current level of maturity and capability objectively, and assist in defining progress towards increased capability. From this point, "maturity" concept is introduced to the organizations, which is a term started to be used to describe

the state of an organization's effectiveness at performing certain tasks (Crawford, 2002). The maturity concept is utilized for benchmarking the current capability against best practices or against competitors, and by determining the strengths and weaknesses in a particular area, to devise improvement strategies. Risk management capability maturity is very important to the project and business performance (Ren and Yeo, 2002), they added such effort should be thoroughly undertaken by organizations for all project and throughout the overall project lifecycle. Some of the project risk maturity model have been established to help for the valuation of the organizational risk management capability for many type of industries. An effort was also differentiate from the literature to implement a basic risk management maturity model to the construction industry.

1.2 PROBLEM STATEMENT

Currently, the construction sector is one of the important activities that contribute to the economic growth. When compared with other manufacturing industries, this industry is known as high fragmentation, low productivity, cost and time overruns, conflicts and disputes characterize the construction industry (Vrijhoef and Koskela. 2000; Love, Irani and Edwards. 2004). Risk and uncertainty are more widespread in the construction industry than any other industries. This is due to the nature of construction business activities, which include processes, environment and organization (Akintoye and MacLeod, 1997). From the beginning to the end, the construction process is complex and characterized by many uncertainties (Al Bahar and Crandall, 1990). Therefore, as pointed out by several authors (Hayes, Perry, Thompson and Willmer, 1986; Flanagan and Norman, 1993; Raftery, 1994; Chapman and Ward, 1997), a risk driven approach is a critical success factor for construction projects. Effective risk management brings about tighter margins and less contingency, making use of opportunities rather than rejecting works as too risky, as well as avoiding unforeseen disasters (Chapman and Ward, 1997). Moreover, the Malaysian construction industry was deliberated, the compatibility and directness of these models for the Malaysian construction companies were in issue. The results of this study this study will provide useful information to construction companies in order to reduce risk effectively in construction.

1.3 RESEARCH OBJECTIVE

This study aim to provide construction risk management maturity models. The following objectives need to be accomplished in order to achieve this aim:

1. To provide a picture of the previously developed maturity models in the area of risk management
2. To determine advantageous and disadvantageous aspects of maturity models by comparing and evaluating them in terms of their usability and effectiveness.

1.4 RESEARCH QUESTION

The questions of this study are:

1. How are the former developed maturity models in the area of risk management?
2. What are the advantageous and disadvantageous aspects of the existed maturity model in terms of their usability and effectiveness?

1.5 OPERATIONAL DEFINITION

Construction industry

Sector of national economy engaged in preparation of land and construction, alteration, and repair of buildings, structures, and other real property (Business Dictionary, n.d).

Project Risk Management

The process of conducting risk management planning, identification, analysis, response planning, and monitoring and control project to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project (PMBOK,2004)

Maturity Model

A service mark that provides a model for understanding the capability maturity of an organisations business processes. A maturity model is specifically used when evaluating the capability to implement data management strategies and the level at which that company could be at risk from said strategies. (Wikipedia, n.d)

1.6 SCOPE OF THE STUDY

The scope of this research was focus on providing a picture of the existed maturity models by comparing and evaluating their usability and effectiveness in the area of construction risk management. There are some researched has assumed that the maturity model needed for an organization in order to benchmark its current maturity and capability in managing risk, and this maturity should also assist in defining progress towards increased maturity. Thus, the components of a construction specific risk management maturity model have been investigated through literature review. By using a risk maturity model, value can be added to a company's operations by improving its performance and enhancing its own future.

1.7 ORGANIZATION OF RESEARCH

This report contains of four chapters, which is this is the first chapter. The second chapter review the literature on risk management, risk management processes, maturity, models of risk management maturity and construction supply chain, views from risk and risk management and finalize them with a discussion on the inferences portrayed from the literature review. The third chapter describes the research method and material, including information on the sample, data collection procedure, and data analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is consisting of the issues found from the literature, which are organized under four main sections. First section comprises the various definition of risk, risk management and related topics, and also explores risk management practices inside the construction companies, it advantages and integration. In the second section discussed the processes of risk management, while the third section is devoted to the maturity concept with an insight to maturity models and risk management maturity.

2.2 CONCEPT OF RISK AND RISK MANAGEMENT

In this section, first of all, the matters of risk and uncertainty, sources of risk and management of risk are clarified with various definitions. Then, in pursuit of a concise look to the history and research of risk management in construction, advantages of risk management are discovered. In conclusion, the integration of risk management with other management roles is briefly explained.

2.3 RISK AND UNCERTAINTY

Risk and uncertainty exist in all construction projects, regardless of its size (Hayes, et al., 1986). Similarly, Chapman and Ward(1997) state that a non-risky project is not worth pursuing, which mean that every project contain some degree of risk. High degree of risk in construction is attributed to the nature of construction business activities, processes, environment and organization (Akintoye and MacLeod, 1997). Risk can be transferred, managed, minimized or shared, but cannot be ignored (Latham, 1994).

Al-Bahar and Crandall(1990) define risk as “the exposure to the chance of occurrences of event adversely or favourably affecting project objectives as a consequence of uncertainty”. According to Al-Bahar and Crandall (1990) also, no uniform or consistent usage of the word “risk” exist in the literature. As Al-Bahar and Crandall (1990) continue in their claim. Most definitions are concerned with the downside of risk, indicating losses and damages, but the upside and opportunities such as profits or gains are often disregarded. Consequently, risk definitions in literature show variety in a way that results of it are always negative, can be positive or negative, or neither is mention and highlighting on the project objectives is being affected. Royal Society (1991) gives definition of risk as “probability that an adverse event occurs during stated period of time”.

Burtonshaw -Gunn (2009) define risk as “the threat or possibility that an action or event will adversely or beneficially affect an organization’s ability to achieve its objectives”. Wharton (1992) states that the word “risk” is simply describing any unintended or unexpected outcome, good or bad, of a decision or course of action. Loosemore, Raftery, Reilly and Higgon (2006), defines risk as a complex phenomenon that has physical, monetory, cultural and social dimensions and is defined as being concerned with the unpredictable events that might occur in the future whose exact likelihood and outcome is uncertain but could potentially affect the interest and objectives of an organization in some way. Project risk may influence one or more of the project objectives. However, a few authors (Akintoye and McLeod, 1997; Smith, Merna and Jobling, 2006; Burtonshaw-Gunn, 2009) give cost, time and quality for the affected project objectives, Mills (2001) adds productivity and performance as subject to risk and uncertainty in construction projects.

Though the terms risk and uncertainty can be used interchangeably, as Merna and Al Thani (2005) make it clearer, their meaning differ in a way that risk refer to statistically predictable occurences whereas uncertainty refer to an unknown of generally unpredictable variability. If a decision maker can assess, either intuitively or rationally, the probability of a particular event occurring, then that decision is made

under risk (Flanagan and Norman, 1993). To draw the relationship between risk and uncertainty, Raftery (1994) established a “risk uncertainty continuum” as in table 2.1.

Table 2. 1 Risk –uncertainty continuum (source : Merna and Al Thani, 2005)

RISK		UNCERTAINTY
Quantifiable	→	Non quantifiable
Statistical Assessment	→	Subjective Probability
Hard Data	→	Informed Opinion

Flanagan and Norman (1993) claims that if there is no historic data or previous history related to the situation being considered by the decision maker, then there is uncertainty. As Flanagan and Norman (1993) add in their claim, the term risk is more relevant for the construction industry than the term uncertainty, as there is always some information to be based on, and by using that information, a company has to convert the uncertainty to risk.

As stated by Allen (1995), risk is composed of four essential parameters. These are likelihood of occurrence, severity of impact, susceptibility to change and degree of interdependency with other factors of risks. As said by Loosemore, et al. (2006), there are risk events and their potential impacts and consequences. In the same way, Kerzner (2005) states that a risk is noted by having a cause and if it occurs, it has a consequences. According to Loosemore, et al. (2006), the probability and consequence terms are used to express and assess risks, and this can be given as : Risk = Probability of event times magnitude of loss/gain.

2.4 SOURCES OF RISK

A company must assess many sources of risks before a decision is decided. The sources of risk occur at different times over an investment (Merna and Al –Thani, 2005). An extensive list of risk sources produced by Merna and Smith (1996) and

reproduced by Merna and Al Thani (2005) is show in Table 2.2 as being a complete outline.

Headline	Change and uncertainty in or due to :
Political	Government law, public authority, change in ideology, dogma, legislation, disorder such as war, riot, terrorism etc.
Planning	Permission requirements, public opinion, land use, policy and practice, socio economic impacts,
Environment	Contaminated land or pollution liability, permissions, nuisance, internal policy, environmental law or regulations or practice.
Market	Demand, competition, obsolesces, fashion, style, customer satisfaction
Economic	Taxation, treasury policy, cost inflation, interest rates, exchange rates
Financial	Bankruptcy, margins, insurance, risk share
Project	Procurement strategy, definition, standards, leadership, performance requirements, organization (maturity, commitment, competence and experience), quality control and planning, labour and resources, communication and culture.
Natural	Unforeseen ground conditions, weather, earthquake, fire or explosion, archaeological discovery.
Regulatory	Changes by regulator
Technical	Design adequacy, operational efficiency, reliability.
Human	Error, incompetence, ignorance, tiredness,

	communication ability, culture, work in the dark at night.
Criminal	Lack of security, theft, fraud, corruption, vandalism.
Safety	Health and safety at work, hazardous substances, collisions, collapse, flooding, explosion and fire.
Legal	Changes in legislation

Table 2.2 Typical sources of risk to business from projects (Source: Merna and Al-Thani, 2005)

The relationship between the source of risk, risk event and its effect is shown by Flanagan and Norman (1993) as in Figure 2.1.

Figure 2.3 Source-event-effect relationships for risk **(**Flanagan and Norman, 1993)

Standard risk sources on a construction project are quoted from Flanagan and Norman (1993) as follows :

- Failure to complete within the stipulated design and construction time
- Failure to obtain the expected outline planning, detailed planning or building code/regulation approvals within the time allowed in the design program
- Unforeseen adverse ground conditions delaying the project
- Exceptionally inclement weather delaying the project
- Strike by the labour force
- Unexpected price rises for labour and materials

- Failure to let to a tenant upon completion
- An accident to an operative on site causing physical injury
- Latent defects occurring in the structure through poor workmanship
- Force majeure (earth quake, flood, etc.)
- A claim from the contractor for loss and expense caused by the late production of design details by the design team
- Failure to complete the project within the client's budget allowance.

The consequences of risks are quoted from Flanagan and Norman (1993) as:

- Failure to keep within the cost budget/forecast/estimate/tender
- Failure to keep within the time stipulated for the approvals, design, construction and occupancy
- Failure to meet the required technical standards for quality, function, fitness for purpose, safety and environment preservation.

2.5 RISK MANAGEMENT

Risk management is labelled as one of the nine knowledge areas of Project Management Body of Knowledge (PMBoK) by PMI. As stated by several authors (Akintoye and McLeod, 1997; Raz and Michael, 2001; Burtonshaw-Gunn, 2009), risk management is a continuous activity and covers the whole project life cycle, from inception through its planning, execution, control, up to its closure. Systematic risk management aims the project to be completed on time, within budget, to the required quality and with proper provision for safety and environmental issues (Mills, 2001). According to Merna and Al-Thani (2005), throughout the life cycle of a project, risk management aims to obtain the optimum or acceptable degree of risk elimination or control.

As stated by Merna and Smith (1996), risk management can be defined as any set of actions taken by individuals or corporations in an effort to alter the risk arising from their business. According to PMI (1996) project risk management is the systematic process of identifying, analysing and responding to project risk. On the contrary,

Crawford (2002) states that risk management aims to identify, analyse, respond and control risk factors throughout the life of a project. Dikmen, Birgonul, Anac, Tah and Aouad (2008) define risk management as a four-step procedure composed of : risk identification, in which the sources of uncertainty are defined. Risk analysis, in which the consequences of uncertain events are evaluated. Risk response, in which appropriate strategies according to the expected outcomes are set forth. Finally, repeating the steps continuously throughout the lifecycle of a project in consideration of the feedback received on actual outcomes and risks emerged, to achieve the project objectives.

Flanagan and Norman (1993) claims that risk management should involve common sense, analysis, judgement, intuition, experience, gut feel and willingness to operate a disciplined approach. Merna and Al-Thani (2005), claims that overcoming risk often have positive impact if managed in the correct way, therefore risk management should consider the opportunities (possible gains) as well as the threats (possible losses).

2.6 RISK MANAGEMENT IN CONSTRUCTION

Risk has become an issue of business literature during the last two decades of the twentieth century (Loosemore, et al., 2006). As Flanagan and Norman (1993) claims, risk management in construction has perhaps a greater significance at 1990s than any other time since the 1970s. Flanagan and Norman (1993) add, this is because of the increased integration between financial and real sectors of the economy and major capital commitments in the building industry. As stated by Merna and Al-Thani (2005), for forward –thinking companies, risk management has become an important issue by the increasing pace of change, customer demands and market globalization. As Merna and Al Thani (2005) continue, the failure of projects to meet their budgets, completion dates, quality and performance or generate sufficient revenues to service the principal and interest payments generate sufficient revenues to service the principal and interest payments generated the need of risk management. The activities of many industries like construction have come into question, putting forward new challenges for managers (Loosemore, et al., 2006). As Loosemore, et al. (2006) continues while traditionally companies were relying on insurance as a mechanism for managing their

risks. Lately, many organizations are conscious and aware that risk management cannot be done merely by passing it on to insurance and finance companies. Risk management is now a important necessity for every construction company.

Flanagan and Norman (1993) claims that construction projects have a large number of risks, contractors cope with it and owners pay for it. As Flanagan and Norman (1993) further state, the complex nature of construction industry comes from the time-consuming design and production processes that a construction project possesses. The route and processes to taking a project from the initial investment evaluation to accomplishment involves a wide range of people with different skills, concerns, and interest, and quite different but interconnected tasks.

The process of taking a project from the initial investment appraisal to completion requires a wide range of people with different skills and interests, and quite different but interrelated activities. The external, unmanageable factors are into the bargain. In spite of all these, managerial methods used to identify, analyse and respond to risk have been implemented in the industry only during the last decade.

On the same way, Mills (2001) points out the very poor reputation for managing risk in the construction industry, although it is one of the most dynamic, risky and challenging businesses. According to several authors(Tah 2005; Kumar and Viswanadham, 2007) a high level of coordianation is needed among various stakeholders who have conflicting interest. As stated by O'brien (1999), construction process has a fragmented nature, often associated with poor productivity. Deadlines and cost targets are failed to be met by many major projects (Mills, 2001). Smith, et al., (2006) extent this claim, with quality, as another frequently missed target in construction projects. As claimed by Al- Bahar and Crandall (1990), the conractors develop rules of thumb based on experience and judgement to deal with risk. According to Mills (2001), Ignorance of risks or simply adding a 10 percent contingency onto the estimated project cost is common. In terms of risk management research, four main areas can be identified from literature that risk management studies are concentrated on (Dikmen, Birgonul and Arikan, 2004).

(1) Development of conceptual frameworks and process model for systematic risk management,
(2) Investigation of risks, risk management trends and perceptions,
(3) Application of risk identification and analysis techniques in specific projects, and
(4) Development of risk management support tools.

2.7 THE IMPORTANCE OF RISK MANAGEMENT

There is clearly an intimate link between effective risk management and the success of projects, since risks are measured by their potential impact on achievement of project objectives. Similarly, Loosemore, et al. (2006), claim that rather than avoiding risk, it is important to take calculated risks by recognizing and managing them effectively. As Loosemore, et al. (2006) continues, the more confident a company is in its risk management systems, the more likely it is able to turn these risks into opportunities to make profits. As claimed by several authors (Kerzner, 2000; Chapman and Ward, 2003), in ensuring successful project management, the single most important factor of function is managing risk. The chances of meeting or even surpassing the predefined project objectives increased by means of comprehensive approach to dealing with risk (Ren and Yeo, 2009). As claimed by Chapman and Ward (2003), organization which have an established risk management capability as a process, obtain an important advantage over competitors.

There are a few sources in the literature that focus on benefits of risk management. A common one is shown in Table 2.3, which is customized from Newland (1992) and Simister (1994) by Merna and Al Thani (2005), sorting the possible benefits of risk management in two types : hard benefits and soft benefits. Loosemore et al. (2006) list important benefits provided by effective risk management as : a better basis for decision making at strategic, tactical and operational levels, better corporate reporting, better use of human resource expertise, increased engagement wit stakeholders, less adverse publicity, a better basis for negotiations, reduced finance costs, increase reliability and quality of services and products, lessons and feedback to

improve future business activities, reduces claim and legal cost, better change management, enhance morale, reduces level of conflict and stress, and enhanced competitive advantage. Another imperative benefit of risk management given by Merna and Al Thani (2005), as it helps to make the stakeholders aware of the risks, both negative and positive, and to manage them effectively. Burtonshaw-Gunn (2009) looks through the effects of ignoring risks and risk management tools, and states that it will cause unfavourable effects on projects, such as cost overruns, schedule delays and inability to achieve desired project technical objectives. Other significant effects are retold as: project de-scoping, loss of credibility, project cancellation and unhappy clients, personal or organizational liability and fines.